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ANTARCTIC PROSPECTS FOR HYPERLEDA

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Abstract. The outstanding atmospheric conditions of the Dôme C give a unique opportunity to survey deeply large areas of the sky in thermal infrared reaching unusual sensitivity limits for ground-based observations. The project of a 3m-class telescope, WHITE, is developed to take benefit of these characteristics.

We present the specific contribution of the HyperLeda to such project and some science cases related to the physics of the Local Universe which requires the approach of HyperLeda.

1 Interest of Dôme C for infrared extragalactic astronomy

Ground-based observations in the thermal infrared (typically from 3 μm and beyond) has to face difficult observing conditions because of only partially clear atmospheric windows and a hugh, rapidly variable background emission. At Dôme C, the extreme temperatures (down to $-80°$C) and dryness (< 0.2 mm PWV) offer unique conditions of transparency and stability of the sky (Fossat 2008). It allows to benefit from remarkable atmospheric transmission in the infrared bands, totally unsual in other terrestrial sites. The very low temperature of the atmosphere implies a very low temperature of the whole telescope infrastructure and instrument leading to a considerable gain, especially in K, L, M bands: up to 4 magnitudes, that extragalactic astronomy will benefit.

1.1 The WHITE project

To make the best use of the exceptional atmospheric characteristics of Dôme C, French members of the ARENA group propose to build a Wide field (0.5 deg in diameter) High resolution (0.3 arcsec using GLAO from the ice) Infrared (1 to 5μm) 3m-class TElescope called WHITE (Wide-field High-resolution Infrared TElescope). Observations could be perform during night and day time. WHITE will be dedicated to carry out surveys: a deep extragalactic field over a few square degrees, a complete survey of the Magellanic Clouds, a high angular resolution survey to detect dusty supernovae up to $z \sim 0.5 - 0.7$. The project is detailed in Burgarella et al. (2008).

The White team closely collaborates with the Australian group led by J. Storey who has a similar project called Pilot (Storey J. et al. 2007) to join the two projects. Pilot is funded for a detailed design study by Australian financial sources.

1.2 HyperLeda involvement

Processing, archiving and distributing the data play a major role in the project to guarantee an optimal scientific return and widest visibility. The goal is to provide homogeneous and high quality data in the shortest delay to the users' community.

Our team proposes to use its expertise in this field (HyperLeda database, DENIS survey, Virtual Observatory) to contribute to the design and deployment of the data processing and archiving of WHITE.

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1.2.1 Data handling and processing

Because of poor data transfert capabilities from Concordia to elsewhere, the data processing has to be performed on the site and in quasi-real time. The raw and reduced data are then transferred off-line to the remote operation center. Before proceeding to the detection and extraction of the sources we must performed: (i) Determination of the precise astrometric solution and (ii) Determination of the PSF. The standard processing pipeline will use a classical source extraction method (sextractor) applied on the integrated image, and for each source a time variability will be characterized.

1.2.2 Data products

The catalogues of extracted sources and the meta-data of the observations will be distributed through HyperLeda. They will be cross-identified with the database HyperLeda in order to construct multi-wavelength spectral energy distributions. For some observations, and in particular for the legacy surveys, some added-value data-products will also be produced. Besides, all the observations of the deep fields or multi-epoch programs will be co-added to achieve the deepest detection.

1.2.3 Virtual observatory

In order to validate and test the complete observational chain, including the data-processing and analysis, we will simulate astrophysical fields, observe them with a virtual telescope -that is simulating the effects of the atmosphere, of the telescope and of the detectors- and process them as real observations. Realistic fields, including source confusion (crowded fields), will be provided using various physical hypotheses. The simulations and the virtual telescope will be made available at an early phase of the instrument in order to assess the performances.

2 The added-value of using HyperLeda

One of our main goal using HyperLeda is to study the physics of galaxies (scaling relations) and their distribution in the Local Universe. Therefore, surveys and catalogues must be combined to derive accurate description of the galaxies. For this purpose, HyperLeda produces homogeneous data, in particular homogeneous estimates of distances, masses and classification (morphological, spectral and activity). Hence, HyperLeda is a database with added scientific value. For WHITE, the multi-wavelength cross-identification will be a critical issue because a field in the M-band is considerably different than in the optical or even in the K-bands. The HyperLeda team developed a long expertise in this field. HyperLeda will provide to the user's community the access to the science-ready data, plus a multi-wavelength cross-identification and physical data on the objects.

K-, L- and M-band observations are of prime importance, specifically for two subjects we are working on:

- the Cepheids PLC-relation, which could give a direct unbiased determination of the distance of any galaxies in which Cepheids have been observed, provided that we dispose of mid-IR observations to minimize the effect of the unknown extinction in the host galaxy,

- the determination of the powerful physical engine in the Ultra-Luminous InfraRed Galaxies (ULIRGs) with the differentation between ULIRGs whith unobscured AGN – having no absorption features and a flat continuum – and ULIRGs with an obscured AGN activity – showing absorption lines at 3.4 μm (due to aliphatic hydrocarbon dust grains) and at 4.6 μm (due to CO gas) together with a steep reddened continuum.

The White telescope at Dome C will give unique opportunity to obtain high quality data on ULIRGs and to obtain intrinsic colors for the Cepheids.

References

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